A Poisson Scaling Model for Estimating Time-Series Party Positions from Texts

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Abstract

Recent advances in computational methods for extracting party positions from political texts have provided scholars promising new ways for estimating party positions. We add to this literature by developing a Poisson scaling technique to estimate positions over time based on word frequencies in political texts. Our approach is more systematic and less time consuming than hand coding of party manifestos or conducting expert surveys. Unlike the computer word scoring methodology by Laver, Benoit & Garry (2003), our method does not require the use of reference texts, the selection of which may greatly influence the estimation process. Lastly, we believe our approach is the first which produces party position estimates which can be used accurately as time-series data. Using simulations, we first demonstrate that our scaling technique produces accurate ideal point estimates. We then estimate the positions of German political parties from 1990-2005 from word frequencies in party manifestos using our *R* program WORDFISH. The extracted positions reflect changes in the party system more accurately than existing time-series positions.

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1 Introduction

Many theories of comparative politics rely on the ability of researchers to locate political parties in a policy space. Theories of coalition formation and duration use party positions to predict which government coalitions form and how long they survive (Baron 1991, Crombez 1996, Strom 1984, de Swaan 1973, Druckman & Thies 2002, Druckman, Martin & Thies 2005, Tsebelis 2002, Warwick 1992). Likewise, theories of law-making use distances between parties to predict policy change (Bawn 1999, Hallerberg & Basinger 1998, Kreppel 1997, Tsebelis 1999), as do analyses of budgetary politics (Tsebelis & Chang 2004, Franzese 2002), globalization and the social welfare state (Garrett 1998), and labor politics (Wallerstein 1999). In fact, all tests of spatial models in comparative politics rely on the ability to estimate party positions.

Despite the importance of party positions to the study of comparative politics, locating parties in a political space over time is a difficult task. Although one might have a good intuition about where parties stand relative to each other, the positions themselves are abstract concepts that cannot be observed directly (Benoit & Laver 2006*b*, chapter 3). To facilitate empirical work, scholars have developed numerous methods for estimating party positions including hand-coding of party manifestos (Budge, Robertson & Hearl 1987, Budge, Klingemann, Volkens, Bara & Tanenbaum 2001), expert surveys (Castles & Mair 1984, Laver & Hunt 1992, Benoit & Laver 2006*b*, Huber & Inglehart 1995), and more recently computer coding of party manifestos (Laver, Benoit & Garry 2003). Despite their near ubiquitious usage, we argue that these methodologies in their current form suffer from drawbacks which limit their usefulness. We propose an easy-to-implement Poisson scaling model using word frequencies in political texts to estimate party positions as well as their associated uncertainty.

We believe that our approach remedies some of the flaws of the previous methods to produce time-series data.

The remainder of the paper reviews the existing methods for estimating party positions. We then introduce our model and explain why it is an advancement over the existing methodologies. Using simulations, we demonstrate that our model performs as we expect. Finally, we use our model to estimate party positions from party manifestos in post-reunification Germany. We find that our estimates make sense, correlate highly with previous methodologies, but are indeed an improvement over previous party position estimates.

2 Current Methods for Estimating Party Positions

Beginning with Downs (1957), theoretical models of party politics assume that parties compete in a policy space. Yet, party positions are unobservable and must therefore be treated as a latent variable in empirical work. Scholars face the challenge of measuring these underlying party positions and policy dimensions. Parties reveal their positions indirectly through a variety of activities. They publish manifestos prior to elections in which they state policy goals, they make political statements and speeches, and their members cast votes in parliaments (Benoit & Laver 2006*b*). Currently, there are three primary methods for estimating latent party positions. The first two, hand-coding and computer-based analysis of manifestos, assume that election manifestos contain precise information about party positions at a particular point in time. The third method, expert surveys, measures the positions not from primary sources, but indirectly through judgments of country specialists who rely on a variety of sources beyond manifestos to form an opinion. A possible fourth method is to analyze the voting records of party members in legislatures. This is the most prominent approach used in presidential systems (e.g. roll call analysis through NOMINATE (Poole & Rosenthal 1985)). However, in parliamentary systems voting patterns unsurprisingly reveal only a division between government parties and opposition parties due to high levels of party discipline and government agenda control (Laver 2006, 137).

2.1 Hand-coding: *Comparative Manifestos Project*

Probably the most popular method for analyzing party positions has been hand coding party manifestos. The *Comparative Manifestos Project* (CMP), previously known as the Manifestos Research Group (Budge, Robertson & Hearl 1987, Budge et al. 2001) has greatly advanced the ability of scholars to conduct comparative research by providing estimates of party positions across countries and over time. Without a doubt, this work has had a massive impact on the field of comparative politics. For the first time, these data allowed scholars to test theories requiring systematic data on party positions over time, even if imperfectly.

However, the hand-coding approach suffers from many drawbacks, which are well known to scholars. The manifestos project has created 56 issues, which fall into seven major categories (external relations, freedom and democracy, political system, economy, welfare and quality of life, fabric of society, and social groups.) To generate party positions, the CMP group code the number of sentences which fall into each issue and then divide by the total number of sentences in the manifesto to control for manifesto length.[1] Thus, the score for each party for each issue is simply the per

[1]Actually they use quasi-sentences. In other words, if a sentence captures two major ideas which

cent of total sentences which fall into this issue.

To calculate party positions on a left-right dimension from these data, scholars have employed several methods. Laver & Budge (1992) provide one of the more commonly used approaches. They identify several important issues as left-wing issues and others as right-wing issues. Then they simply sum the left-wing scores and the right-wing scores and subtract the right totals from the left totals. This creates numerous problems. For example, imagine two parties with very short manifestos. The first party's manifesto reads, "We support more social welfare spending." The second party's manifesto reads, "We support more social welfare spending. Decisions about this spending should be made at the local levels." Because 100% of the first party's manifesto deals with a left-wing issue, the party's score on the left-right dimension would be 1, or as far left as possible. The second party's score, on the other hand, would be 0.5 by this coding scheme. The first sentence, 50% of the manifesto, falls into a left-wing category. The second sentence, however, deals with decentralization, an issue which is coded neither left nor right. We would not want to conclude, though, that party 1 is actually located to the left of party 2 simply because party 1 remained silent on a neutral issue.

Problems such as this are run throughout the coding scheme. It is difficult to identify right and left issues, and this may vary across countries. For example, in the US, decentralization would be a right-wing issue while in other countries it may be a neutral issue, or even a left-wing issue. Moreover, it is not clear that all issues should be given the same weight in determining party positions, and, again weights may vary across countries and time. In one election, social policy may be very prominent and

fit into two separate issues, they count it as two sentences.

should be given more weight, while in another election economic policy may have been more important. There is no way to know this or account for this in the manifesto project coding scheme. As demonstrated above, even a missing position on an issue which researchers perceive as neutral can change a party's left-right position. The fixed coding scheme of the *Comparative Manifestos Project* also means important new issues must be placed into existing categories (e.g. global terrorism after 9/11). Other categories may no longer be relevant (e.g. foreign special relations between West and East Germany after 1990).

There have been several attempts to fix the manifesto scheme. Gabel & Huber (2000), for example, suggest simply extracting the first principal component from the 56 issues, an approach they refer to as the *vanilla method*. Others have retained the seven main categories in the original dataset and then extracted principal components from each category (Klingemann 1995). Gabel & Huber (2000) also make significant advances by examining the extent to which researchers can accurately make comparisons across countries and time using the manifesto data. Nevertheless, these methods remain unsatisfactory. First, because the manifestos have been coded only once, we do not know the errors associated with this technique and the reliability and validity of the data. Second, the coding scheme of left-right positions itself is problematic and can lead to invalid positions.

2.2 Expert Surveys

Expert surveys also provide a popular method for examining party positions. They have certain distinct advantages over the manifestos approach. Surveys allow researchers to examine specific issues at a specific point in time. Huber & Inglehart

(1995), for example, are able to assess the continued relevance of the left-right dimension in a post-communist world, both in newly democratized countries and in their western counterparts. Such surveys may be able to examine when new issues arise and their relative importance. Moreover, experts are able to tell researchers what, in their opinion, are the salient dimensions, rather than leaving the researcher to guess or assign arbitrary weights. Earlier surveys assumed *a priori* low-dimensional policy spaces and asked experts to locate the parties on a left-right continuum (Castles & Mair 1984, Huber & Inglehart 1995). More recent surveys, such as Benoit & Laver (2006*b*), take into account the fact that politics is multidimensional. Benoit and Laver conduct an expert survey of party positions in 47 countries covering the time period 2002-2003 in a high dimensional issue space. In an ideal world, regularly conducted expert surveys may provide the best means for estimating latent party positions. Experts are able to synthesize large quantities of information about parties from various sources, including manifestos, speeches, voting patterns, and media reports.

From a pragmatic standpoint, however, expert surveys are difficult and expensive to repeat over time and across countries, requiring continous sources of funding to conduct new surveys at regular intervals. Often, they require multi-lingual research teams. If a researcher realizes there was a question that the survey should have included, but didn't, it is virtually impossible to go back in time to retrieve that information. Often different surveys phrase questions differently, making the comparisons across surveys questionable. Moreover, it is difficult to know whether different experts across various countries and times understand and answer the questions in a similar manner. While surveys often come up short as pooled time-series data, they do provide researchers with a method for checking the validity of position estimates from other methods (Gabel & Huber 2000).

2.3 Computer-based Text Analysis

The most recent innovation in estimating party positions involves computer scoring of party manifestos. These methods attempt to both reduce the costs and likelihood of human error associated with hand-coding texts. Earlier computer coding schemes relied on linking texts with computer-based dictionaries containing words or phrases associated with predetermined policy positions (Laver 2001). However, as Laver, Benoit & Garry (2003, 312) note, this method does not actually cut down on the human effort as it requires teams of researchers to input large, hand-coded dictionaries, and therefore the likelihood of human error remains.

Laver, Benoit & Garry (2003) make great advances in computer word-scoring by suggesting the use of reference texts rather than hand-coded dictionaries. Using this approach, researchers must first identify reference texts known to represent the extremes of the political space. Laver, Benoit and Garry's computer program *word-scores* then counts the number of times each word occurs in each reference text and compares these word counts to word counts from the texts being analyzed. The texts of interest are then placed on a continuum between the reference texts depending on how similar the word counts are to each reference text.[2] It is difficult to over-estimate the importance of this breakthrough. It presents a method which is both easy to implement and one which researchers can apply in almost any setting. The only requirement is the ability to identify reference texts and to have all texts in computer-readable format.

[2] See Laver, Benoit & Garry (2003) for a complete description of how their algorithm works.

Despite its clear advances over previous methodologies, there are problems with the *wordscores* approach. First, its usefulness hinges on the ability of the researcher to identify appropriate reference texts, a task which is not always easy and may involve subjective judgments. Often, reasonable scholars can disagree about what represents the extremes of the political space. This becomes particularly tricky over time (Budge & Pennings 2006*a*). Moreover, there are issues with the particular algorithm that Laver, Benoit and Garry use to scale policy positions (Martin & Vanberg 2006).

The problems associated with existing manifestos-based aproaches have meanwhile sparked a lively debate among scholars (Budge & Pennings 2006*b*, Benoit & Laver 2006*a*). Benoit and Laver point out that hand-coding can lead to uncertainty due to human error, which researchers are unable to account for. In addition, the benchmark categorical scheme set up in the late 1970s may be outdated. Budge and Pennings, in contrast, underscore that the *wordscores* has its limits in the use of reference texts, something which Benoit and Laver have not failed to mention in their initial article (Laver, Benoit & Garry 2003).

3 A Poisson Scaling Approach to Party Positions

Our model retains the advantages of the computer-based word frequency technique, but eliminates many of the existing problems. We present an easy to implement model to estimate policy positions from political texts. Like other manifesto-based position estimates, this assumes that how often a party mentions specific words relative to all other parties provides information about its placement in a policy space. The advantage to our approach is its parsimony and ability to produce time-series position estimates. It does not require the use of reference texts, calibrating dictionaries, or knowledge of the language.

3.1 Theory

Like the *wordscores* approach, we analyse word frequencies in party manifestos. But rather than comparing word frequencies of documents of interest to those of reference texts, we assume the frequencies are generated by a Poisson process. This means that the number of times party i mentions word j in election year t is drawn from a Poisson distribution. This particular distribution is amenable to this problem both because it generates positive integers (i.e. the word counts) and because it only has one parameter, λ, which is both the mean and the standard deviation. Monroe & Maeda (2004) use a similar model specification to estimate positions of members of the US Congress from speeches. The functional form of our model is as follows:

$$Word_{ijt} \sim Poisson(\lambda_{ijt})$$

$$\lambda_{ijt} = exp(\alpha_{it} + \psi_j + \beta_j * x_{it})$$

where ψ is a set of word fixed effects, α is a set of party-election year fixed effects, x is the estimate of party i's position in election year t, and β is an estimate of a word specific weight capturing the importance of word j in determining party positions. We include word fixed effects to capture the fact that some words are used much more often than other words by all parties. The party-election year effects control for the possibility that some parties in some years may have written a much longer manifesto. The parameters of interest are the x's, the position of the parties in each election year, and the β's because they allow us to analyze which words differentiate between party positions.

Our model specification treats each election manifesto as a separate party and we estimate all positions simultaneously. In other words, the position of party i's manifesto in election *t-1* does not constrain the position of party i's manifesto in election t. This specification has the advantage that observed party movement is, in fact, due to changes in word frequencies and not an artifact of our model. It does assume, however, that words are used in a similar fashion across elections.

3.2 Estimation

The only data in our model are word frequencies. This means that, unlike a standard Poisson regression model, there are no independent variables. To estimate the model, we use an expectation maximization (EM) algorithm. The EM algorithm is an iterative procedure to compute maximum likelihood estimates for latent variables (McLachlan & Krishnan 1997). The E step involves calculating the expectation of the latent variable as if it were observed. The M step then maximizes the log-likelihood conditional on the expectation. The implementation of this algorithm entails the following steps.

Step 1: Calculate starting values.

> The model involves estimating a very large number of parameters. Suppose over the course of four elections, five parties publish manifestos which together contain 1,000 unique words. We would then need to estimate 1,000 ψ's, word fixed effects, 1,000 β's, word weights, plus 20 α's, party fixed effects, and 20 x's,

party positions, for a total of 2,040 parameters. This means that good starting values are essential for the model to converge quickly. We obtain starting values for word fixed effects (ψ) by calculating the logged mean count of each word:

$$\psi_j^{start} = log\left(\frac{\sum_{it=1}^{n} wordcount_{ijt}}{n}\right).$$

For the party fixed effects (α), we use the logged ratio of the mean word count of each party-election manifesto relative to the first party-election in our dataset. We set the starting values relative to the first party-election because this party-fixed effect is set to zero during the estimation in order to identify the model:

$$\alpha_{it}^{start} = log\left(\frac{\sum_{j=1}^{m} wordcount_{ijt}/m}{\sum_{j=1}^{m} wordcount_{j,it=1}/m}\right).$$

To obtain starting values for word weights (β) and party positions (x) from the word frequencies, we first subtract the starting values for the word and party fixed effects from the logged word frequencies: $y^*_{ijt} = log(y_{ijt}) - \alpha_{it}^{start} - \psi_j^{start}$. We then use the left and right-singular vectors from a singular value decomposition of the y^* matrix to compute x_{it}^{start} and β_j^{start}.

Step 2: Estimate party parameters.

We estimate party parameters (x and $alpha$) conditional on our expectation for the word parameters. In the first iteration, our expectation of those word parameters equal their starting values calculated in step 1. We maximize the following log-likelihood for each party-election it:

$$\sum_{j=1}^{m} \left(-\lambda_{ijt} + ln(\lambda_{ijt}) * y_{ijt}\right),$$

where

$$\lambda_{ijt} = exp(\alpha_{it} + \psi_j^{start} + \beta_j^{start} * x_{it}).$$

We use x_{it}^{start} and α_{it}^{start} as starting values in the maximization stage. To identify the model, in addition to setting α_1 to 0, we set the mean of all party positions across all elections to 0 and the standard deviation to 1 using a z-score transformation:

$$x_{it} = \left(\frac{x_{it} - \bar{x}}{SD(x)}\right).$$

This identification strategy allows party positions to change over time relative to the mean position because we only assume that the variance of all positions *over time* remains the same. We do not hold the variance or the mean in each election constant, as this would not allow us to make interpretations about party movements over time.

Step 3: Estimate word parameters.

We estimate word parameters (*psi* and β) conditional on our expectation for the party parameters, which we obtain in step 2. For each word j, we maximize the log-likelihood:[3]

$$\sum_{it=1}^{n} \left(-\lambda_{ijt} + ln(\lambda_{ijt}) * y_{ijt}\right),$$

where

$$\lambda_{ijt} = exp(\alpha_{it}^{step2} + \psi_j + \beta_j * x_{it}^{step2}).$$

Step 4: Calculate log-likelihood.

The log-likelihood of our model is the sum of the individual word log-likelihoods from step 3, which are themselves calculated conditional upon the party log-likelihoods from step 2:

$$\sum_{j}^{m} \sum_{it=1}^{n} \left(-\lambda_{ijt} + ln(\lambda_{ijt}) * y_{ijt}\right).$$

Step 5: Repeat steps 2-4 until convergence.

Using the new expectations for the word parameters, we re-estimate party parameters (step 2). Then, using those expectations, we re-estimate word parameters (step 3). We repeat this process until we reach an acceptable level of convergence. We measure convergence by the difference in the log-likelihood from step 4 between the current and the previous iteration. When this difference is sufficiently small (0.1), we stop the algorithm. Alternatively, we could use the differences in parameter estimates, but we find that both approaches produce the same result.

[3]We include in this log-likelihood a relatively diffuse word-specific prior in order to prevent words from carrying infinite weight. The prior belief is that βs are distributed normally with mean of zero and standard deviation σ. This reduces the weight given to words that are mentioned very infrequently (e.g. by only one party in one election) which might otherwise discriminate perfectly. The prior solves a technical problem, but has no effect on our estimated party positions.

3.3 95%-Confidence Intervals

We obtain confidence intervals for our estimates using a parametric bootstrap. We first estimate the parameters by running the EM algorithm using our data as described above. From these ML estimates, we calculate each λ_{ijt}. We then generate 500 new datasets by taking random draws from Poisson distributions with parameters λ_{ijt}. Using the ML estimates as starting values, we run our algorithm on each of these datasets. We use the 0.025 and the 0.975 quantiles of the 500 simulated party positions as an approximate 95%-confidence interval. Our method for estimating party positions is one of few which allows researchers to measure the uncertainty associated with the estimation.[4]

3.4 *R* Program: WORDFISH

To implement this routine, we have written a computer program for the *R* statistical language called WORDFISH.[5] As input, our program requires a word frequencies matrix. Several good programs already exist to create word frequency datasets from text documents. We use the *wordfreq* program, a Stata plug-in that is part of Laver, Benoit & Garry (2003)'s *wordscores* package. WORDFISH then takes the word frequency dataset, generates starting values, and runs the algorithm. It outputs the party positions along with the word weights and party and word fixed-effects. In addition, the program can generate confidence intervals from a parametric bootstrap.

To demonstrate that our program produces valid parameter estimates, we run a

[4] See Laver, Benoit & Garry (2003) and Monroe & Maeda (2004) for other techniques for estimating policy positions from political texts with standard errors.

[5] Our program name pays tribute to the French meaning of *poisson*. Our program and replication data will be made available on the authors' websites shortly. The *R* language is open-source and available for free at www.R-project.org.

simulation on fake data. We generate word counts using our Poisson model specification as the data generating process. This is done in three steps. First, we set the true parameter values. These are drawn from random distributions so that the resulting word counts resemble real manifesto data.[6] Second, we generate the word frequencies by taking random draws from a Poisson distribution using the true parameter values to calculate λ_{ijt}. Finally, we run the code which calculates the starting values and then performs the EM algorithm. The estimated parameters correlate highly with the true values. The correlation between estimated party positions and the truth is always greater than 0.99. The other parameter estimates correlate with the truth at .9 or greater. This demonstrates that our code is able to recapture all parameters with a high degree of accuracy.

4 Estimates for German Parties, 1990-2005

We apply our technique to estimate the positions of German parties in the post-reunification era (1990-2005).[7] The estimation requires three steps: defining policy dimensions, generating the word frequency dataset, and running the algorithm. We perform two analyses: a left-right dimensional analysis using the entire manifesto of each party in each election, and a multidimensional analysis using particular sections of each manifesto (economic, societal, foreign policies).

[6] Specifically, we draw the word parameters from a logit distribution and the party-fixed effect parameter from a uniform distribution. Party positions are set at fixed values.

[7] German Manifestos in electronic format were made available from the Zentralarchiv für Empirische Sozialforschung, Universität zu Köln. The manifestos were transferred into electronic format by Paul Pennings and Hans Keman, Vrije Universiteit Amsterdam, Comparative Electronic Manifestos Project, in cooperation with the Social Science Reserach Centre Berlin (Andrea Volkens, Hans-Dieter Klingemann) the Zentralarchiv für empirische Sozialforschung, GESIS, Universität zu Köln, and the Manifesto Research Group (chairman: Ian Budge).

Our first analysis has the major advantage over other word frequency analyses in that it requires absolutely no knowledge of the language. This is because we do not need *a priori* dictionaries of words or reference texts. Since we use the entire manifesto text, we expect that our results capture the basic left-right dimension of German politics. In the second analysis, we calculate scores for individual dimensions of interest. Here, we concentrate our analysis on economic, societal, and foreign policies. [8] This approach does require knowledge of the language because it is necessary to read the manifestos and extract those sections that deal with the respective policies. Each manifesto text is thus divided into three separate files. We then run our algorithm on each dimension separately and retrieve three positions for each party.[9]

INSERT TABLE 1 HERE

Table 1 lists the sections of the manifestos and their assignment to those three dimensions.[10] The economic dimension captures socio-economic policies including taxes, revenues, and spending. The foreign dimension covers international political and economic affairs as well as relations with the European Union. Finally, the societal dimension includes the remaining parts of the manifestos and is therefore a residual category. It includes diverse areas such as higher education, immigration, housing, and sport. Once the dimensions are defined and the manifesto texts are compiled, we generate a word frequency dataset. The rows of this matrix correspond

[8] We use the term "societal" rather than "social" because we believe the term societal is broader. We include several issues in this dimension, such as environmental politics, which are not usually categorized as social politics, but they clearly have societal ramifications.

[9] These are three separate uni-dimensional positions. In other words, there is no way to know whether these dimensions are orthogonal to one another, nor do we know the relative weights of the dimensions.

[10] We excluded the following manifesto sections from the analysis: general introduction of a manifesto/preamble, review of the previous parliamentary term, reference to other parties and their manifesto, conclusion of a manifesto.

to a party manifesto from a particular election and the columns to all unique words mentioned in the texts. This means that we have 25 rows (5 parties, 5 elections) and several thousand columns depending on the number of unique words for each dimension. While it is possible to estimate positions using the entire party-word matrix, we remove words that parties use infrequently and thus contain little information about their placement. We include a word in the estimation if it was mentioned at least once on average by each party during the period between 1990 and 2005. This has three practical advantages. First, it speeds up the estimation process by eliminating the "long tail" in our data set. There are many words which parties mention very infrequently. Second, it ensures that our estimation results do not hinge on these infrequently mentioned words. Lastly, it eliminates the possibility that spelling mistakes or other minor and infrequent errors affect our estimates.[11]

INSERT TABLE 2 HERE

Table 2 presents a summary of the estimation results, including the number of unique words, the number of party-elections, the number of iterations, the log-likelihood, and the mean absolute difference in the estimated party positions between the last and the previous iteration. German parties use about twice as many words to talk about economic and societal policies as they do for foreign policy. The code takes between 18 and 178 iterations to converge. At convergence, the mean difference in party positions is very small. The total number of parameters being estimated can be calculated by doubling the number of unique words and party-elections and adding them up. For instance, for the left-right dimension, WORDFISH estimates

[11]We wrote a PERL script to eliminate party labels, transform all letters into lowercase, and remove bullet points and numberings from the texts.

18,040 parameters.

INSERT TABLE 3 HERE

Table 3 presents the estimated German party positions since 1990 on all dimensions. Figure 1 plots the estimates for the main left-right dimension along with 95%-confidence intervals. The estimates reflect several important changes in the party system over time. Since reunification, the former East-German communist *Party of Democratic Socialism* (PDS) has occupied the left end of the political spectrum. The *Greens* start out on the left in 1990, but move slightly towards the political center up until the most recent election in 2005. This movement reflects the transformation of the *Greens* from an environmentalist fringe party in the 1980's to a mainstream governing party by 1998. Most importantly, our estimates pick up the significant right shift of *Social Democratic Party* (SPD) throughout the 1990s. This matches conventional wisdom that Chancellor Gerhard Schröder moved the traditional left-wing socialist party to the political center to recapture government in same way that Tony Blair moved the British Labour Party to the center with his "Third Way." In addition, we see a left shift by both the SPD and the PDS in 2005. This is explained by a split in the SPD. The left wing of the SPD, led by former party leader Oskar Lafontaine, was upset by the party's rightward movement under Schröder and split off to form a new party together with the PDS, *Die Linke*. The SPD needed to move left to placate their base and to avoid losing even more party members to *Die Linke*. Finally, the liberal *Free Democrats* (FDP) and the conservative *Christian Democrats* (CDU-CSU) are further to the right and remain relatively stable over time. The FDP tends to be slightly to the right of the CDU-CSU up until 2005, when it moves to the center. The 95%-confidence intervals for all parties are narrow. In fact, there are only two instances in which our results suggest that one party is indistinguishable from another party. In 1990, the *Greens* and the PDS have overlapping confidence intervals, and so do the FDP and the CDU-CSU in 2005.

INSERT FIGURE 1 HERE

Figure 2 plots our party estimates for the economic, societal and foreign dimensions. On the economic dimension, our analysis confirms that the liberal FDP is clearly the most conservative party, demanding lower taxes and less public spending. This is reflected by the large gap between this party and the CDU-CSU. The two largest German parties (SPD and CDU-CSU) are closest to each other in 2002 and 2005. Following the 2005 election, the two parties formed a grand coalition government. In general, all party positions remain relatively stable over time on the this dimension.

Our societal dimension captures a wide range of policies, including immigration, education, and environment. The most significant finding for this dimension is that all parties except the *Greens* move to the left in 2005. In the context of German electoral politics, this was the year when the SPD chancellor decided to hold early elections because some of his own party members had switched over to the PDS. The FDP is still to the right of all parties. This party is often thought to be located between the SPD and the CDU-CSU on social policies. However, our dimension includes more than just social policies, making it difficult to compare this dimension to other estimates of social policy positions.

On foreign policy, we see a similar ranking of parties. The *Greens*, which emerged from an anti-war, pro-environmental social movement, and the PDS are located close together during the first half of the 1990s. Once the *Greens* enter government in 1998, their policy positions shifts slightly towards the center. The SPD makes its most significant ideological shift throughout the 1990s, when it moves from a leftist position towards a centrist position on foreign policy. Again, this change is likely to be associated with the SPD taking over government responsibility in 1998. The CDU-CSU and the FDP have similar positions. In 1990 and 2005, the FDP is more centrist and located between the two major parties.

INSERT FIGURE 2 HERE

In summary, our estimated positions reflect conventional wisdom on the German party system and its changes after reunification in 1990. To further confirm our findings, we check the validity of our results both internally and externally. For internal validiation, we identify the twenty words with the largest weights (β) on each dimension. Table 4 reports the words that are most important for placing parties on the left and the right. On the left-right dimension, words like "womens' movement" and "fascism" are mentioned much more often by left-wing parties. Parties on the right, on the other hand, use words such as "income taxation", "non-wage labor costs" and "education vouchers".

On the economic dimension, we find that words such as "workers' participation", "quota", "mobility" and "negotiated wages" matter most. All of these are words which we would associate with economic and labor policy. Likewise, on the societal dimension we find references to "process of reunification", "university graduates", "sexuality" and "climate catastrophe". With words as diverse as these, the results reinforce our belief that this is a residual category capturing societal politics broadly defined. Lastly, words such as "unilateral", "NGOs", "weapons production", and "armies" all clearly refer to the foreign and defense policy domain. In addition, right parties often refer to the European defense and security policy (EDSP), the European police agency (Europol) and to the EU budget.

Although we do not report them here, we also find that conjunctions, articles and prepositions have low word weights and high word fixed effects, just as we would expect. These words do little to discriminate between the parties, but at the same time, are mentioned much more often by all the parties. The fact that the weights are largest for words carrying political meaning demonstrates that our model is capturing the policy space.

INSERT TABLE 4 HERE

Finally, we cross-validate our results with existing methods (hand-coding of manifestos, expert surveys, and *wordscores*). We use the following data to cover the spectrum of methodologies:

- **Hand-coding of manifestos:** We use the *Comparative Manifestos Project* left-right scale and three policy scales for Germany, 1990-1998 (Budge et al. 2001). The CMP data constitute the only comparable time-series dataset. The three policy scales are market economy (MARKECO), welfare state (WELFARE), and international peace (INTPEACE). We assume that these correspond to our economic, societal, and foreign dimensions.

- **Expert survey:** We use expert estimates from Benoit & Laver (2006*b*) on a left-right dimension and on a taxes vs. spending dimension for 2002-2003.

- **Wordscores method:** The computer-based text analysis by Laver, Benoit & Garry (2003) estimates German positions for 1990 and 1994 on an economic and social dimension. Proksch & Slapin (2006) applied their method to estimate German positions in 2005 to predict the coalition formation process following the election.

Table 5 presents the correlations between the position estimates. The correlations between our Poisson scaling model and the other three methods is high, suggesting that the techniques provide similar placement of parties in the political space. Almost all coefficients range between 0.8 and .98. Only our broad societal category corresponds less well to social and welfare categories of the other measures.

INSERT TABLE 5 HERE

As a final cross-validation, Figure 3 directly compares our left-right dimension with the *Comparative Manifestos Project* left-right scale for the years 1990-1998. The CMP data suggest major changes in the party system that are inconsistent with standard accounts of German politics. First, it locates the conservative CDU-CSU closer to the *Greens* than to any other party in 1990 including its governing partner the FDP. Second, it suggests that the social-democratic SPD shoots from being next to the former communists to the position of the free-market Free Democrats, crossing the position of the Green party. It is inconceivable that a major centrist party in an established multi-party system would make such a jump. Moreover, expert survey data do not find that the SPD is to the left of the Greens in 1990 (Huber & Inglehart 1995). In contrast, our method provides less extreme party movements in the 1990s, eliminating the unlikely cross-overs suggested by the CMP data. We find that the SPD makes a more modest move relative to the other parties, remaining in the center of the space throughout the period. Our estimates furthermore match the rankings of the parties the Huber and Inglehart expert survey data. In general, our findings for the German party system correspond well with other methods for estimating party positions. When used as time-series data, our estimates substantially improve upon previous estimates by providing smoother party movements than those found in the CMP data.

INSERT FIGURE 3 HERE

5 Conclusion

We have presented a new methodology for estimating time-series party positions (and their 95%-confidence intervals). Our approach improves over existing methods by providing a computer-based text analysis which does not require the use of reference texts or dictionaries. We retain the advantages of both the *Comparative Manifestos Project* and Laver, Benoit & Garry (2003)'s *wordscores* technique, while eliminating many of their disadvantages. Like the *Comparative Manifestos Project*, our method creates rich time-series data, but does not require teams of potentially error-prone hand-coders to do so. At the same time, like *wordscores*, we provide easy to implement computer code which researchers can apply to virtually any set of political texts. Our method only requires party manifestos of those parties whose positions are to be estimated. In contrast, the *wordscores* approach relies on the use of reference texts, the choice of which is often subjective and can greatly affect the results of the estimation.

Using our *R* program WORDFISH, it is much easier to estimate ideological positions in settings where it is difficult to identify the nature of the policy dimension or to find knowledgeable experts. This may make our method particularly applicable to the study of developing countries or countries with unstable party systems where it is difficult to identify reference texts. In a cross-national research design, the relative placement of parties within countries is useful for testing any number of comparative politics theories, although these positions are not directly comparable across countries as both language and political space vary. Therefore, cross-national studies can use positions generated by our method by including country fixed effects. We plan to expand our analysis by estimating positions for German parties for the entire post-World War II era. Eventually, our goal is to produce a cross-national time-series dataset that will offer scholars an alternative to the CMP data.

While our primary interest is in estimating party positions, our program can be applied to any political texts, including speeches and other documents. The large advantage of our approach is the ability to process and estimate positions from historical documents, without making *a priori* assumptions about the distribution of preferences.

We have demonstrated that our approach produces estimates of party positions which correspond well with positions from other estimation techniques. We are able to accurately portray the German party system in the 1990-2005 post-reunification era. Our estimated positions correlate highly with expert surveys, CMP project estimates, and the *wordscores* computer coding method. However, our approach is much less cost and time intensive, and it is easily replicable with WORDFISH.

References

Baron, David P. 1991. "A Spatial Bargaining Theory of Government Formation in Parliamentary Systems." *American Political Science Review* 85(1):137–164.

Bawn, Kathleen. 1999. "Money and Majorities in the Federal Republic of Germany: Evidence for a Veto Players Model of Government Spending." *American Journal of Political Science* 43(3):707–736.

Benoit, Kenneth & Michael Laver. 2006*a*. "Benchmarks for text analysis: A response to Budge and Pennings." *Electoral Studies* .

Benoit, Kenneth & Michael Laver. 2006*b*. *Party Policy in Modern Democracies.* London: Routledge.

Budge, Ian, David Robertson & Derek Hearl. 1987. *Ideology, Strategy, and Party Change: Spatial Analyses of Post-War Election Programmes in 19 Democracies.* Cambridge: Cambridge University Press.

Budge, Ian, Hans-Dieter Klingemann, Andrea Volkens, Judith Bara & Eric Tanenbaum. 2001. *Mapping Policy Preferences: Estimates for Parties, Electors, and Governments 1945-1998.* Oxford: Oxford University Press.

Budge, Ian & Paul Pennings. 2006*a*. "Do they work? Validating computerised word frequency estimates against policy series." *Electoral Studies* .

Budge, Ian & Paul Pennings. 2006*b*. "Missing the message and shooting the messenger: Benoit and Laver's 'response'." *Electoral Studies* .

Castles, Francis G. & Peter Mair. 1984. "Left-Right Political Scales: Some Expert Judgements." *European Journal of Political Research* 12:73–88.

Crombez, Christophe. 1996. "Minority Governments, Minimal Winning Coalitions and Surplus Majorities in Parliamentary Systems." *European Journal of Political Research* 29(1):1–29.

de Swaan, Abram. 1973. *Coalition Theories and Cabinet Formation*. Amsterdam: Elsevier.

Downs, Anthony. 1957. *An Economic Theory of Democracy*. New York: Harper.

Druckman, James N., Lanny W. Martin & Michael F. Thies. 2005. "Influence without Confidence: Upper Chambers and Government Formation." *Legislative Studies Quarterly* 30(4):529–548.

Druckman, James N. & Michael F. Thies. 2002. "The Importance of Concurrence: The Impact of Bicameralism on Government Formation nd Duration." *American Journal of Political Science* 46(4):760–771.

Franzese, Robert J. 2002. *Macroeconomic Policies of Developed Democracies*. Cambridge: Cambridge University Press.

Gabel, Matthew J. & John D. Huber. 2000. "Putting Parties in Their Place: Inferring Left-Right Ideological Positions from Party Manifestos Data." *American Journal of Political Science* 44(1):94–103.

Garrett, Geoffrey. 1998. *Partisan Politics in the Global Economy*. Cambridge: Cambridge University Press.

Hallerberg, Mark & Scott Basinger. 1998. "Internationalization and Changes in Tax Policy in OECD Countries: The Importance of Domestic Veto Players." *Comparative Political Studies* 31:321–352.

Huber, John D. & Ronald Inglehart. 1995. "Expert Interpretations of Party Space and Party Locations in 42 Societies." *Party Politics* 1(1):73–111.

Klingemann, Hans-Dieter. 1995. Party Positions and Voter Orientations. In *Citizens and the State*, ed. Hans-Dieter Klingemann & Dieter Fuch. Oxford: Oxford University Press.

Kreppel, Amie. 1997. "The Impact of Parties in Government on Legislative Output in Italy." *European Journal of Political Research* 31:327–350.

Laver, Michael. 2006. Legislatures and Parliaments in Comparative Context. In *Oxford Handbook of Political Economy*, ed. Barry Weingast & Donald Wittman. Oxford University Press.

Laver, Michael, ed. 2001. *Estimating the Policy Positions of Political Actors*. London: Routledge.

Laver, Michael & Ian Budge, eds. 1992. *Party, Policy, and Government Coalitions.* London: St. Martin's Press.

Laver, Michael, Kenneth Benoit & John Garry. 2003. "Extracting Policy Positions from Political Texts Using Words as Data." *American Political Science Review* 97(2):311–332.

Laver, Michael & W. Ben Hunt. 1992. *Policy and Party Competition.* New York: Routledge, Chapman and Hall.

Martin, Lanny W. & Georg Vanberg. 2006. "A Robust Transformation Procedure for Interpreting Political Texts." Polmeth working paper.

McLachlan, Geoffrey J. & Thriyambakam Krishnan. 1997. *The EM Algorithm and Extensions.* New York: J. Wiley.

Monroe, Burt L. & Ko Maeda. 2004. "Talk's Cheap: Text-Based Estimation of Rhetorical Ideal-Points." 21st Annual Summer Meeting, Society for Political Methodology, Stanford University July 29-31.

Poole, Keith & Howard Rosenthal. 1985. "A Spatial Model for Legislative Roll Call Analysis." *American Journal of Political Science* 29(2):357–384.

Proksch, Sven-Oliver & Jonathan B. Slapin. 2006. "Institutions and Coalition Formation: The German Election of 2005." *West European Politics* 29(3):540 – 559.

Strom, Kaare. 1984. "Minority Governments in Parliamentary Democracies." *Comparative Political Studies* 17(2):199–227.

Tsebelis, George. 1999. "Veto Players and Law Production in Parliamentary Democracies: An Empirical Analysis." *American Political Science Review* 93(3):591–608.

Tsebelis, George. 2002. *Veto Players: How Political Institutions Work.* Princeton, NJ: Russell Sage/Princeton University Press.

Tsebelis, George & Eric Chang. 2004. "Veto Players and the Structure of Budgets in Advanced Industrialized Countries." *European Journal of Political Research* 43:449–476.

Wallerstein, Michael. 1999. "Wage-Setting Institutions and Pay Inequality in Advanced Industrialized Societies." *American Journal of Political Science* 43(3):649–680.

Warwick, Paul. 1992. "Ideological Diversity and Government Survival in Western European Parliamentary Democracies." *Comparative Political Studies* 25(3).

Policy Dimension	**Included manifesto sections**
Economic Policy	agriculture, budget, revenue, taxes, consumer protection, deregulation, energy, future policies, general health policy, industrial policy, infrastructure, labor market, pensions, policies concerning Eastern Germany, research and development, trade, welfare state
Societal Policy	animal rights, culture, direct democracy and constitutional reform, anti-drug and HIV policies, children, education (including higher education), environmentalism (except energy policy), family, fight against extremism and terrorism (except on the international level), gender equality, housing, immigration, law and order, traditional morals, multiculturalism, seniors (except pensions), sport
Foreign Policy	defence and security, European Union, global affairs, international terrorism, world trade

Table 1: Definition of Policy Dimensions.

Dimension	**Unique Words**	**Party-Elections**	**Iterations**	**LL**	**Diff. in x**
Left-Right	8995	25	111	841237.4	$8.22*10^{-4}$
Economic	4714	25	178	233023.5	$2.48*10^{-3}$
Societal	4817	25	26	247732.2	$2.19*10^{-3}$
Foreign	2200	25	18	62880.7	$2.10*10^{-3}$

Table 2: Estimation Overview.

Election	**Party**	**Left-Right**	**Economic**	**Societal**	**Foreign**
2005	PDS	0.93	-0.68	0.91	1.00
	Greens	0.39	-0.65	0.54	0.64
	SPD	-0.42	-0.45	0.31	-0.48
	CDU	-1.06	0.38	0.04	-1.16
	FDP	-0.98	1.54	-0.97	-0.87
2002	PDS	0.83	-0.66	0.44	0.89
	Greens	0.63	-0.66	0.67	0.62
	SPD	-0.64	-0.11	-0.08	-0.66
	CDU	-0.92	0.37	-0.31	-1.10
	FDP	-1.09	1.56	-1.76	-1.13
1998	PDS	1.32	-0.98	0.95	1.01
	Greens	1.09	-0.83	0.89	1.31
	SPD	-0.39	-0.56	0.36	-0.57
	CDU	-0.99	0.36	-0.79	-0.79
	FDP	-1.19	1.77	-1.86	-1.09
1994	PDS	1.48	-0.95	1.12	1.36
	Greens	1.17	-0.87	0.80	1.19
	SPD	-0.03	-0.51	0.36	-0.22
	CDU	-0.86	0.53	-0.14	-1.05
	FDP	-1.17	1.94	-1.87	-1.08
1990	PDS	1.46	-1.01	1.09	1.33
	Greens	1.51	-1.05	1.12	1.37
	SPD	0.55	-0.55	0.51	0.97
	CDU	-0.69	0.26	-0.41	-0.93
	FDP	-0.94	1.81	-1.93	-0.57

Table 3: Party Positions

Dimension	Top 10 Words placing parties on the... Left	Right
Left-Right	Federal Republic of Germany (BRD) immediate (sofortiger) pornography (Pornographie) sexuality (Sexualität) substitute materials (Ersatzstoffen) stratosphere (Stratosphäre) womens' movement (Frauenbewegung) fascism (Faschismus) Two thirds world (Zweidrittelwelt) established (etablierten)	general welfare payments (Bürgergeldsystem) introduction (Heranführung) income taxation (Einkommensbesteuerung) non-wage labor costs (Lohnzusatzkosten) business location (Wirtschaftsstandort) university of applied sciences (Fachhochschule) education vouchers (Bildungsgutscheine) mobility (Beweglichkeit) peace tasks (Friedensaufgaben) protection (Protektion)
Economic	Federal Republic of Germany (BRD) democratization (Demokratisierung) to prohibit (verbieten) destruction (Zerstörung) mothers (Mütter) debasing (entwürdigende) weeks (Wochen) quota (Quotierung) unprotected (ungeschützter) workers' participation (Mitbestimmungs-möglichkeiten)	to seek (anzustreben) general welfare payments (Bürgergeldsystem) inventors (Erfinder) mobility (Beweglichkeit) location (Standorts) negotiated wages (Tarif-Löhne) child-raising allowance (Erziehungsgeld) utilization (Verwertung) savings (Ersparnis) reliable (verlässlich)
Societal	Federal Republic of Germany (BRD) climate catastrophe (Klimakatastrophe) sexuality (Sexualität) pornography (Pornographie) fascism (Faschismus) irreplaceable (ersatzlos) process of reunification (Wende) womens' movement (Frauenbewegung) substitute materials (Ersatzstoffen) nuclear facilities (Atomanlagen)	data processing (Datenverarbeitung) contraception counseling (Verhütungsberatung) requested (aufgefordert) questions regarding property (Eigentumsfragen) competitive sports (Leistungssport) leisure activities (Freizeitverhalten) in general (generell) animal protection law (Tierschutzgesetzes) social housing fee (Fehlbelegungsabgabe) university graduates (Hochschulabsolventen)
Foreign	Federal Republic of Germany (BRD) immediately (sofort) departure (Aufbruch) foreign political (aussenpolitischer) unilateral (einseitiger) Two thirds world (Zweidrittelwelt) emancipation (Emanzipation) NGOs (NGOs) armies (Armeen) weapons production (Rüstungs-produktion)	cultural policy (Kulturpolitik) auswaertige (foreign) Europol (Europol) legal protection (Rechtsschutz) delimitation of competences (Kompetenz-abgrenzung) neglected (vernachlässigt) EDSP (EVSP) euro-atlantic (euro-atlantischen) introduction (Heranführung) EU budget (EU-Haushalt)

Table 4: Top Ten Words placing parties on the left and right

	Poisson Scaling Model			
	Left-Right	Economic	Societal	Foreign
Hand-coding manifestos				
CMP: Left-Right (n=15, 1990-1998)	-0.82			
CMP: Markeco (n=15, 1990-1998)		0.81		
CMP: Welfare (n=15, 1990-1998)			0.58	
CMP: Intpeace (n=15, 1990-1998)				0.81
Expert Survey				
Benoit/Laver 2006: Left-Right (n=5, 2002)	-0.91			
Benoit/Laver 2006: Taxes-Spending (n=5, 2002)		0.86		
Wordscores				
Benoit et al. 2003: Economic (n=10, 1990-1994)		0.93		
Benoit et al. 2003: Social (n=10, 1990-1994)			-0.47	
Proksch/Slapin 2006: Economic (n=5, 2005)		0.98		
Proksch/Slapin 2006: Social (n=5, 2005)			-0.47	

Table 5: Crossvalidation: Correlations between German Party Position Estimates.

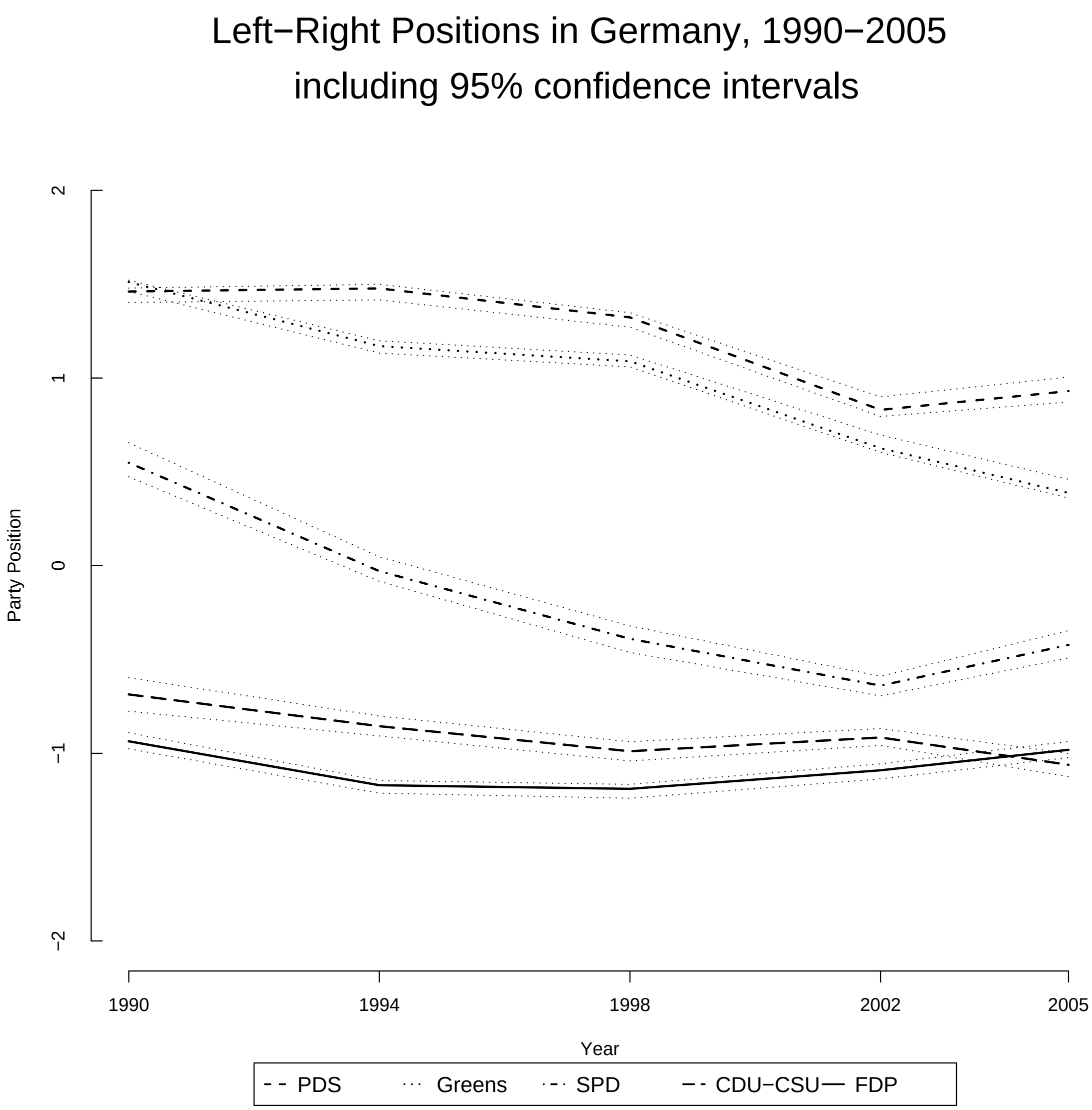

Figure 1: Left-Right Party Positions in Germany

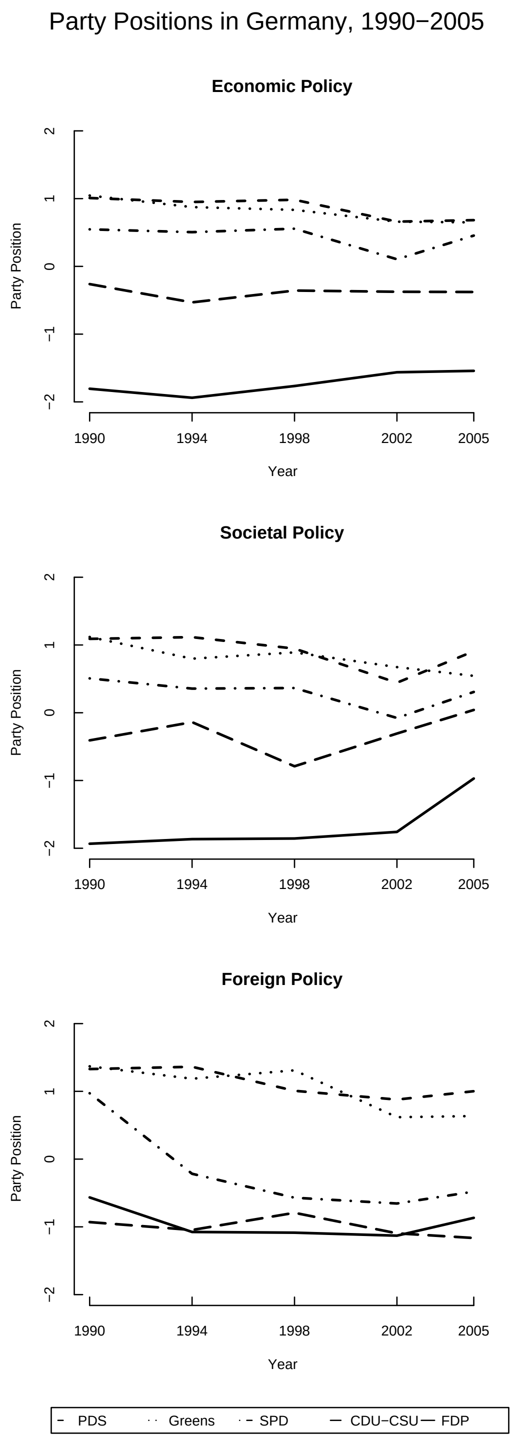

Figure 2: Party Positions in Germany

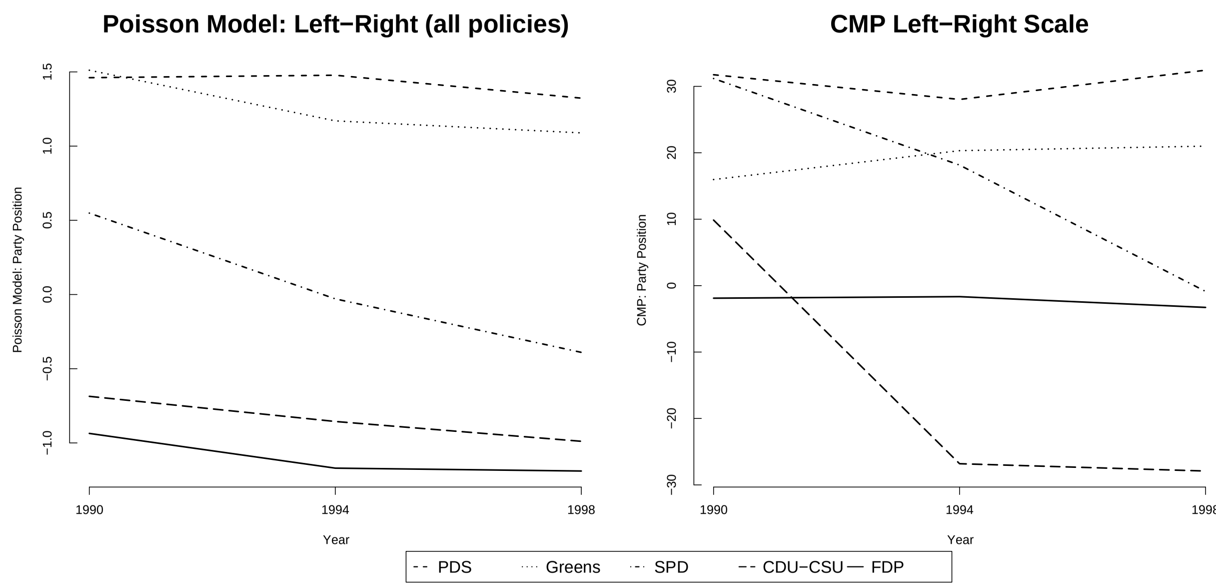

Figure 3: Comparison of Left-Right Positions in Germany 1990-1998